

Offshore Alaska Chukchi and Beaufort Seas

Seismic Surveys

Overview / Description

November 3, 2005

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Seismic 3-D Surveys

Purpose

Marine three-dimensional (3-D) seismic surveys are the current industry standard method of gathering subsurface information in the offshore environment. They provide a detailed image of geological structures such as bedding layers and faults. This information is essential for exploration and production of hydrocarbons. The improved information from 3-D seismic relative to older two-dimensional seismic allows exploration well to be drilled with a higher likelihood of success as well as reducing the number of development wells required.

Overview of Marine 3-D Seismic Acquisition

In the seismic method, reflected sound energy, produces graphic images of seafloor and sub-seafloor features. The seismic system consists of sources and detectors, the positions of which must be accurately measured at all times. The sound signal comes from arrays of towed energy sources. These energy sources store compressed air which is released on command from the towing vessel. The released air forms a bubble which expands and contracts in a predictable fashion, emitting sound waves as it does so. Individual sources are configured into arrays. These arrays have an output signal which is more desirable than that of a single bubble and also serves to focus the sound output primarily in the downward direction which is useful for the seismic method. This array effect also minimizes the sound emitted in the horizontal direction.

The downward propagating sound travels to the seafloor and into the geologic strata below the seafloor. Changes in the acoustic properties between the various rock layers result in a portion of the sound being reflected back toward the surface at each layer. This reflected energy is received by detectors called hydrophones, which are housed within submerged streamer cables which are towed behind the seismic vessel. Data from these hydrophones are recorded to produce seismic records or profiles. Seismic profiles often resemble geologic cross-sections along the course traveled by the survey vessel.

During the seismic acquisition the vessel to be used, the M/V Gilavar, is operated by WesternGeco. Specifications for the Gilavar are included in Appendix 1. The Gilavar will tow two source arrays, comprising three identical subarrays each, which will be fired alternately as the ship sails downline in the survey area. Additional information on the source arrays is included in Appendix 2. The Gilavar will tow up to 6 streamer cables up to 5,400 meters (m) long. With this configuration each pass of the Gilavar can record 12 subsurface lines spanning a swath of up to 360 m.

The Gilavar will be accompanied by a support vessel, M/V Alex Gordon, which is owned and operated by Northern Transport Company Limited (NTCL). The Alex Gordon is an icebreaker class support vessel which will be used to resupply and refuel the Gilavar. Specifications for the Alex Gordon are included in Appendix 3. The presence of second vessel adds to the safety of the operation in the event of a marine emergency.

Operational Plan

It is planned that the Gilavar will stop in Dutch Harbor to pick up crew members and refuel near the end of June 2006. She will be in the Chukchi in early July to begin deploying the acquisition equipment. Seismic acquisition is planned to begin on or about July 10, 2006. The approximate area of operations are shown in Appendix 4. Acquisition will continue in the Chukchi Sea until ice conditions permit a transit into the Beaufort Sea around early August. Seismic acquisition is planned to continue in the Beaufort at one of three 3-D areas until early October depending on ice conditions. These 3-D areas are shown in Appendix 5. For each of these 3-D areas, the Gilavar will traverse the area multiple times until data over the area of interest has been recorded. At the conclusion of seismic acquisition in the Beaufort Sea, the Gilavar will return to the Chukchi Sea and resume recording data there until near the end of October.

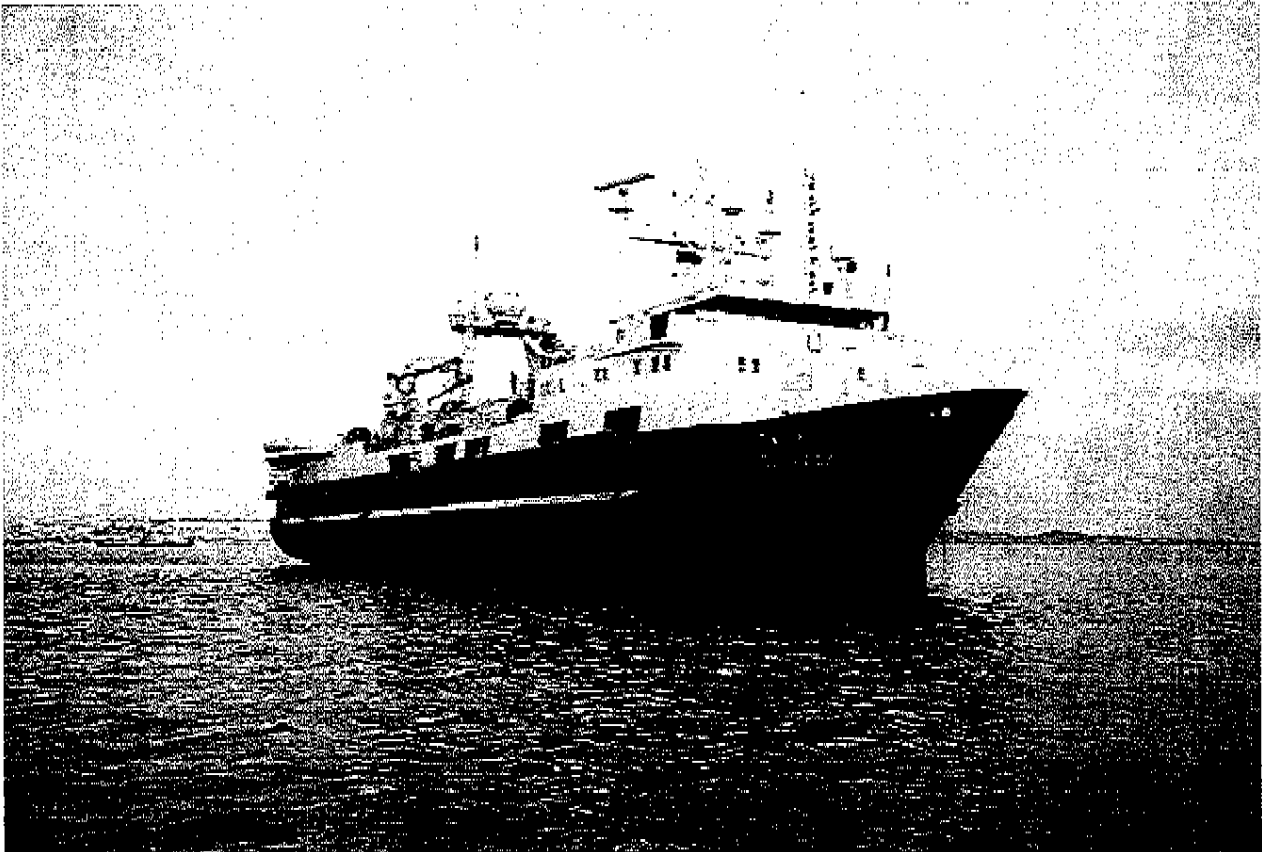
Marine Mammal Mitigation Plan

Several trained Marine Mammal Observers (MMOs) will be stationed on the Gilavar. Trained MMOs will include local observers from the communities of the North Slope Borough. Two MMOs will be on duty at all times when data are to be recorded. The MMOs will record any marine mammal sightings and will have the authority to stop seismic acquisition whenever a marine mammal enters the defined exclusion zone. If the sources are shut down for some period, they will only be started again after a 30-minute observation period by the MMOs. At the end of the observation period, the source arrays will be "ramped up" by starting with a single source and then gradually increasing the number of elements fired over a 30-minute period at which time the full source arrays will be used.

The output from the energy sources as well as from the vessels themselves will be measured upon the vessels arrival in the Beaufort Sea. An independent, third-party vendor will be contracted to perform these measurements.

Appendix 1

<p>VESSEL SPECIFICATIONS M/V GILAVAR</p>
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WesternGeco reserves the right to alter specifications without prior notice.

Maritime Specifications / Particulars**Main Particulars**

Ships Name	"GILAVAR"
Call sign	4JKW
International Maritime Org. (IMO) No.	8008539
Owner	Caspian Geophysical Ltd. Baku, Azerbaijan.
Previous Name	"Geco Gamma"
Flag state & port of registry	Azerbaijan, Baku
Azerbaijan Official No.	12885
Date of Build	February 1981
Hull No. and type of vessel	132 / Seismic Research Vessel / "Trosvik-Class"
Yard built	Trosvik, Norway
Date converted / power upgraded	April 1994 / April 1998 / August 2003
Yard converted	Motorwerken, Bremerhaven, Germany.
Classification Society and Class	Navy dock Yard, Baku by Transmarine
DNV Class ID No.	RMRS / DNV+1A1 - EO - Ice C - Helideck.
Main Class renewal	12885
Classification Machinery System	04/2004. Valid to year 2009
Class approved maintenance system	Planned Maintenance System (PMS) Year 1997
International Safety Management, (ISM) code compliance	1 x Electronic plan / rec. TM-Master 1.76. Build 76.
Safe Manning certificate (minimum)	Replaced RAST OM 3.81 in 03.02.
	RMRS June 02, 2002. Renewal next due: June 05.
	12 Maritime crewmembers. (Galley dep. not incl.)

Principal Particulars

Gross tonnage (GRT)	3953 metric ton.
GRT national & international	3953 / 3953 metric ton.
Gross tonnage (GRT) Suez canal	N/A
Net registered tonnage (NRT) Panama Canal	N/A
NRT National & International	1186
NRT Suez canal	N/A
Lightship displacement	2773 metric ton.
Deadweight	1359 metric ton
Length over all (LOA)	84.90 m
Length between perpendiculars	75.80 m
Breadth (moulded)	18,4
Breadth (extreme)	19.1 m Helideck (NB! Hinged flap on stb side)
Depth (moulded)	8.60 m
Summer draft (max)	5.3 m
Draft (mean)	
Air draft (to highest antenna)	28.1 m at design draft 5.30 m
Helicopter Deck rating	Bell 214 / Super Puma / Year 1994
Helicopter Deck diameter (D-value)	19.10m
Helicopter Deck markings standard	Azal Helicopter Company / CAA UK

Capacities And Endurance's

HP air source, standard m ³ / hour	2 x 2700, 1 x 1224. Total 6624 m ³ at 4.8 knots
Engine Room HP air compressors	2 x Spetec.
Pulling power, dynamic at full ahead	27 ton at 4.5 knots water speed.
Fresh water capacity	4 tanks. Total x 208 metric tons
	1 x Evaporator 6 - 16 m ³ /day, dependent on engine load.
Fresh water maker production	1 x Reverse Osmosis, 12 m ³ / day.
Potable water system	1 x Common potable & wash water system.
Fuel capacity, all tanks topped	14 x tanks. Total x 810 m ³ .
Fuel, useful for 100 % consumption	730 m ³ (3 days safety margin in addition)
	Marine Gas Oil (MGO) Grade DMA Distillate. Standard: ISO 8217,1996. Grade ISO 8216,1985
Fuel type	ISO 8217,1996. Grade ISO 8216,1985
Fuel tank heating	None.
Lube oil, engine oil (m ³)	2 x tanks. Total x 22 m ³ Shell Gadina 40
Cylinder oil, HP compressors (m ³)	2 x tanks. Total x 6.75 m ³ Mobil Rarus 827.
Cable oil, kerosene (clean/separated/dirty)	3 x tanks. Total x 21.1 m ³ , Isopar M
Ballast, sea water (m ³)	6 x tanks. Total x 316 m ³
Speed, transit, max in calm sea	14 knots (336 nautical miles/24 hours)
Speed, transit economy, ditto	11 knots (264 nautical miles/24 hours)
Consumption x fuel, full speed	18.6 m ³ / 24 hours
Consumption x fuel, economy speed	12 m ³ / 24 hours (only 2 generators in service)
Operational endurance	39 days at full speed / 60 days at economy speed
Endurance x fuel during survey	45 - 23 days, dependent on configuration x gear.
	Minimum 16 m ³ , maximum 32 m ³ per 24 hours at full thrust. Azimuth Thruster and 3 HP compressors
Consumption x fuel during survey	3 m ³ / 24 hours
Consumption x fuel in port	3 m ³ / 24 hours
Safety equipment certificate	Maximum 50 persons allowed onboard when at sea

Bridge Navigation Equipment

Radar no 1	1 x Krupp Atlas 9600, ARPA X-band, Y 1996
Radar no 2	1 x Krupp Atlas 8600, ARPA S-band, Y 1986
Radar no 3	None
ECDIS	None
Gyro compass	1 x Robertson RGC 11
Auto-Pilot	1 x Robertson AP 9 MK II with Robnav.
AIS	SAAB R4 AIS Class A Transponder System
GPS receiver (for AIS)	Furuno GP-90
GPS receiver	1 x Raystar 390 GPS
Speed log	1 x JRC: JLR-203 Doppler log
Echo Sounder	1 x Simrad EN-200 Bridge. 1 x EA-500 in I-room
Radio's, VHF, GMDSS*, type 1	1 x Shipmate RS8100
Radio's, VHF, GMDSS*, type 2	3 x Sailor 2048, 2 with DSC.
Radio's, VHF, GMDSS*, type 3	None
Radio's, UHF	6 x Motorola GP300
Radio direction finder	1 x Furuno VHF Direction finder FD 525
Weather facsimile	1 x Furuno WFR Fax 108.
NAVTEX receiver	1 x JRC, NRC 300 A
UPS, power supply to all GMDSS radio's	1 x Metric M-2000, Year 1994

Communication Equipment, Compliant With GMDSS Requirements

Radio Station license No.	00547 Azerbaijan (23776-B Panama)
Class / corr. category	33a CP H8
Ship / Aircraft radio	1 x (type unknown), 1 x Portable, ICOM
Helicopter Beacon	1 x RS110 + Automatic keying device 6ANG
Transmitter / receiver, main (MF)	1 x Sailor C2140 Simplex
Transmitter / receiver, reserve (MF)	1 x Skanti 8000, Year 1994
Transmitter / receiver, main (VHF)	4 x Sailor RT 2048
Transmitter / receiver, main (DSC)	1 x GMDSS, VHF DSC RM 2042
Radio, portable, UHF	6 x Motorola GP 300
Booster unit for portable radio (UHF)	1 x base repeater, TP Radio 6725 B.
Emergency radio beacon (EPIRB)	1 x Tron 30S MK II
Radar transponder	2 x Tron Sart 9
Radio, Liferaft, VHF	4 x Sailor 3110

Satellite Communications

Inmarsat type B	1 x Nera Satum B Mk2
Inmarsat type C	1 x Sailor H2095B
Inmarsat telephone No./ Fax No./HSD (64kb)	+873-342309010 / +873-342309012 / +873-391015139
V-Sat	Spacetrack 4000 SESAT
V-Sat online Tele-link to Aberdeen, 24 hrs	(+44) 2075 766865 - (+1) 713 296 5365
Telefax machine	1 x Canon T-301 (Sat), 1 x Panafax UF450 (Mob)
TV-Satellite receiver	1 x Skipper DMC. 4 channels internally distributed
Internal E-mail & PC-network	12 x Work areas and Senior staff cabins
E-mail address to vessel	Department head title before @ i.e. Party_Chief or Captain@gilavar.vessel.caspian.slb.com

Safety Equipment Crew

Liferaft davits	2 - One either side x Bridge Deck
Liferafts type / capacity	6 Viking 25DKF (25 persons),
Number x life rafts	1 MOB raft, Viking 6DKR (6 persons)
Lifejackets no.	6 (MOB raft excluded)
Survival suits, Thermo Insulated	43 x Seamaster 83, 38 x Seamaster 69,
Work suits, Thermo Insulated	20 x T-vest 87. Total No. Onboard: 101
Man overboard boat (MOB) type	44 x Helly Hansen E 305-7, E 305, E353. 6 x Helly Hansen
Engine, MOB and speed x boat	E 351, E 305, D 602. Total No. Onboard: 50
Waterjet and gear drive, mob	9 x Helly Hansen E 300-2
Work boat	1 x Springer MP-741. Year 1996
Engine, work boat and speed x boat	1 x Cummings 6B TA5. 9M2, 30 knots / 2400 rpm
	Hamilton 273 with Borg Warner 72 C.
	Norpower 25 feet. Year 1999
	Cummings Diesel 220 hp. 15 knots.

Fixed Fire Extinguisher System

Engine room	7 x Halon 1301. Year 1981
Separator room	1 x Halon 1301 (combined with tape store)
Tape store	1 x Halon 1301 (combined with scp. room)
Incinerator room / Galley ducting	None
Cable store	1 x Sprinkler system, foam AFFF. Year 1994
Steamer Winch Room	1 x Sprinkler system, AFFF, plus full coverage x CO2
Helicopter deck	1 x Foam monitor, AFFF
Paint store	1 x Seawater sprinkler system. Year 1994
Chemical store	1 x Sprinkler system, foam AFFF. Year 1994
Main foam pump, AFFF foam mixture	1 x 110 m ³ /h 8 bar (Engine Room starboard)
Main fire pump	2 x 32 m ³ /hr 8 bar. (Engine room stbd.fwd and port aft)
Emergency fire pump	1 x 32 m ³ /hr 8 bar. (EL driven, B/T room)
Fire detection monitoring system	1 x 12 loops, Servoteknik AS, entire vessel, Y -96

Hull Outfitting

Anchor	2 Stockless - Hall type
Windlass	2 x Norwinch Type: 1A33/38-36 "Split", Y -81
Mooring winches	2 x Capstan on end x each windlass.
Capstan no 1	1 x Br. Bauer-Nilsen, 5 ton (stbd. shelter deck) Y -96
Capstan no 2	1 x Br. Bauer-Nilsen, 5 ton (port shelter deck) Y -81
Deck crane 1, capacity/reach/location	1 x Hydralift 5,5 ton/ 16,5 m / stbd side, Y 1999
Decks crane 2, capacity/reach/location	1 x Has 30h, 3 ton/ 10 m. / port side, Y 1981
Stores / personnel elevator	1 x Fortuna - load 500 kg
Anti rolling damping system	1 x Flume tank (passive) under Heli-deck. Y-94
Heeling tanks, volume and fuel/FW/SW	2 x 30 ton fuel each, active system, bridge operated.
Bunker connections, locations	2 on shelter deck, each side. 1 on bow.
Bunker connections, type(s)	Flange ND100/220 mm
Bunker hose length and dimension (loose)	Yes / 3 x 6", 10 m length, total 30 m. Year 1995
Crew accommodation, no x bunks	50
Single berth cabins	30. Each cabin with toilet and shower.
Double berth cabins	10 x Each cabin w/toilet and shower.
Client cabins, single berth	1 x All facilities incl. Live TV and video. Y 1998
Business conference and training room	1 x 12 persons. TV / video / 2 x computers
Sauna and fitness room	1 x sauna, 1 x well equipped fitness room. Y 1996

International Oil Pollution Prevention (IOPP) Equipment

Incinerator, sludge and waste oil	1 x Fredrikstad 2.1 L. Year 1981
Bilge / oily water separator	1 x ROW. SKIT S 2.5 (ton/h) Year 1997 Compliance
Oily water / sludge tanks cap.	MARPOL 73/78. IMO Res. A 393 (x)
Oil spill absorbent / damage control	4 x Total 102 m ³
Sewage treatment plant	2 x Absorbent kits + 200 l. chem. Seacare O.S.D
Sewage/grey water holding tank capacity	ORCA IIA-70 / Marine Sanitation Device. 9,46 m ³
Waste compactor	170m ³ / 20 days
	1 For tins and sheet metal recycling

Machinery Equipment

Air capacity, each and total (cfm)	2 x 2700, 1 x 1224. Total 6624 m ³ /hr.
HP compressor drive motors, large	2 x ASEA 60 Hz 600V, Y 825A MF 560L 660 kW
HP compressor drive motors, small	1x ABB 60 Hz 600V, Y 410A M2BA 355/360 kW
Main engine or electric prop. motors	4 x Asea LAB-450 LN 600kW, tot. 2400 bkW. Y-98
Redundancy propulsion, Azimuth thruster	1 x Brunvoll AR-LNC-1650 / 736 bkW. Year 1994
Vessels total brake hp / kw for prop.	1 x 2400 kW and 1 x 736 kW = 3136 bkW/4265 bhp
Main engines, power supply	4 x SCR (rectifiers) convert DC power to M/E. Y-81
Auxiliary engines (generator drive)	4 x Bergen Diesel KRGB-9 x 2065 bhp Tot. 8260 bhp
Aux. Engine manufacturer nos. 1 to 4	Nos. 2865, 2863, 2864, 2915. Year 1998
Aux. eng. turbochargers	1 x Brown Boveri ser. No. HT-344738, Type: VTR250, Specification ZB8C19.8 IVMH 110AW3P/A2
Propeller type, main propulsion	1 x 4 blade, Hjelseth, CPP / bronze / Nozzle. Y -94
Propeller, noise & pitch control	1 x Step-less adjustment x pitch/rpm (10-240 rpm)
Propeller blade, spare	1 x Ulstein / bronze. Stored in cable store. Y 1994
Generators / Alternators	4 x ABB/AMG 560 S8, 1900kva / 1445 kW. Y -98
Electric power, useful, out from main switchboard	4 x 1400 kW, 600V 60 Hz each. Tot. X 5600 kW
UPS power to instrument room	1 x Merlin Gerin 80 KVA. 15 min. back up. Y -98
Power supply instrument room back -up	1 x Watt AS Rotating conv. SGB 434/4KR. Y -81
Emergency & Harbour generator engine	1 x Cummings Diesel, NTA-855-G. Year 1980/-99
Emergency & Harbour generator	1 x Stamford MC534C. 440V / 250 kW. Y 1980
Fuel back-up system for aux. eng.	1 x Automatic changeover if main system fails. Year 1995
Cooling system for aux. engines	2 x Segregated systems. 2 x eng. on each. Y -98
Bow thruster	1 x Brunvoll SPT VP 600 / 450 kW. Year 1981
Azimuth thruster	1 x Brunvoll AR-LNC-1650 / 736 bkW
Stern thruster	None
	1 x Alfa Laval Nircx 10-11. Year 1994
Fresh water generator (FWG)	1 x Atlas Reverse Osmosis 12m ³ per day
Boiler, exhaust gas & oil fired	1 x Pyro A800-1500 Hot water boiler, 85° C. Y -94
Steering gear	1 x Porsgrunn 260-12. Dual type, 2 pumps. Y -81

Seismic Specifications

Main Particulars

Streamers	8 (Max spread 6 x 6km limited by propulsion power x 27 tons)
Tow Points	8
Sub Arrays	6 x Sub Array Y1998 Y (Max 8)

Energy Systems

Gun Controller (Type & Manufacturer)	WesternGeco TRISOR 1.5
Guns (Manufacturer, Type & Capacities)	Bolt - Long Life Airgun, 1500 & 1900 – 30m ³ to 290m ³
Nominal Source Pressure	2000 psi
Pressure Release	Solenoid
Sensor Return	Piezoelectric
Timing Resolution	0.1 ms
Source	Combinations x variable sub arrays, up to 6 strings
Total Compressor Capacity	3900 CFM
Compressors (Manufacturer & Capacity)	2 x Burchardt B5S 1.55.1 – 1590 CFM 1 x LMF 200HD – 720 CFM
Near Field Phone (Manufacturer & Type)	WesternGeco, HD-1TC (Typically one NFP per ultrabox)
Far Field Phone (Manufacturer & Type)	None
Depth Indicators	TSED Fjord – Pt # P20004931

Streamer Systems

Streamer (Manufacturer & Type)	TMS Solid Streamer Sentry/Guardian 150m
Streamer Deflector Type	Doors 300%
Section Breaking Strength (Typical)	>60 kN
Typical Towed-Streamer Stress	1000 - 2500 kg
Streamer Capacity (Max)	24000m
Nap-4	None
Streamers Vs. Length (Max)	1 x 8000m to 4 x 6000m
Nap-4	None
Streamer Spread (Max Spread Configuration)	300m using 300% doors
Streamer Control Device (Manufacturer & Type)	DigiCourse, 5011
Recording System (Manufacturer & Type)	Serco, Syntrak 960-24

Navigation Systems

Instrument Room Gyrocompass (Manufacturer & Type)	SG Brown SGB 1000
Source Positioning System (Manufacturer & Type)	Navia Maritime A/S, Seatrack 330
Global Positioning System (GPS) Receivers (Manufacturer & Type)	2 x Novatel, Millennium dual frequency 1 x leica, MX9400 single frequency
DGPS Qc System (Manufacturer & Type)	PDN Norway, TRINAV rGPS
Integrated Navigation System (Manufacturer & Type)	PDN Norway, TRINAV RT 2.6.0
3-D Quality Control System (Manufacturer & Type)	PDN Norway, TRINAV QC
Tailbuoy (Manufacturer & Type)	PDN Norway, TAG 3
Tailbuoy Navigation (Manufacturer & Type)	Navia Maritime A/S, Seatrack 220
Onboard Tailbuoy Positioning (Manufacturer & Type)	PDN Norway, TRINAV rGPS
Ultra-Short Baseline (USBL) Acoustic Positioning System (Manufacturer & Type)	None
Acoustic Positioning System (Manufacturer & Type)	Sonardyne, SIPSI & HGPS
Current Profiler (Manufacturer, Type & Frequency)	RDI, ADCP, 600kHz
Temperature/Salinity Dip Profiler (Manufacturer & Type)	12 x Sippicans 1 x Valeport, Mk600
Echo Sounder (Manufacturer & Type)	1 x Simrad EA-500
Transducer Frequency & Theoretical Range	1 x 38 kHz to 3400m 1 x 18 kHz to 9000m 1 x 200 kHz to 200m
Transducer Draft	-5.75m
Recording System	
Format	P1/90, P2/94, SPS, SEG-D for acquisition tapes
Media	IBM 3590 tape
Device	IBM 3590

Other Systems

Single & Multi-Trace Plotter (Manufacturer & Type)	OYO, GS 622
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Onboard Seismic Qc

System	Omega QC
Software	Omega
Hardware	SUN Enterprise 6000

Onboard Seismic Processing

System	TRIPRO
Software	Omega (Latest Version)
Hardware	SUN enterprise 6000

Note:

Additional system, equipment, hardware and, software information may be available. Please refer to the appropriate specification sheets and/or manuals for more information.

Appendix 2

WesternGeco's 3147 in³ Bolt Gun Array for 3-D Operations

WesternGeco's source arrays are composed of identically tuned Bolt gun sub-arrays operating at 2,000 psi, air pressure. In general, the signature produced by an array composed of multiple sub-arrays has the same shape as that produced by a single sub-array while the overall acoustic output of the array is determined by the number of sub-arrays employed. In this manner WesternGeco can offer a consistent source signature across our fleet of survey vessels.

The gun arrangement for the 1049 in³ sub-array is detailed below.

Standard 1049 in³ sub-array - 3 subarrays comprise each 3147 in³ Source

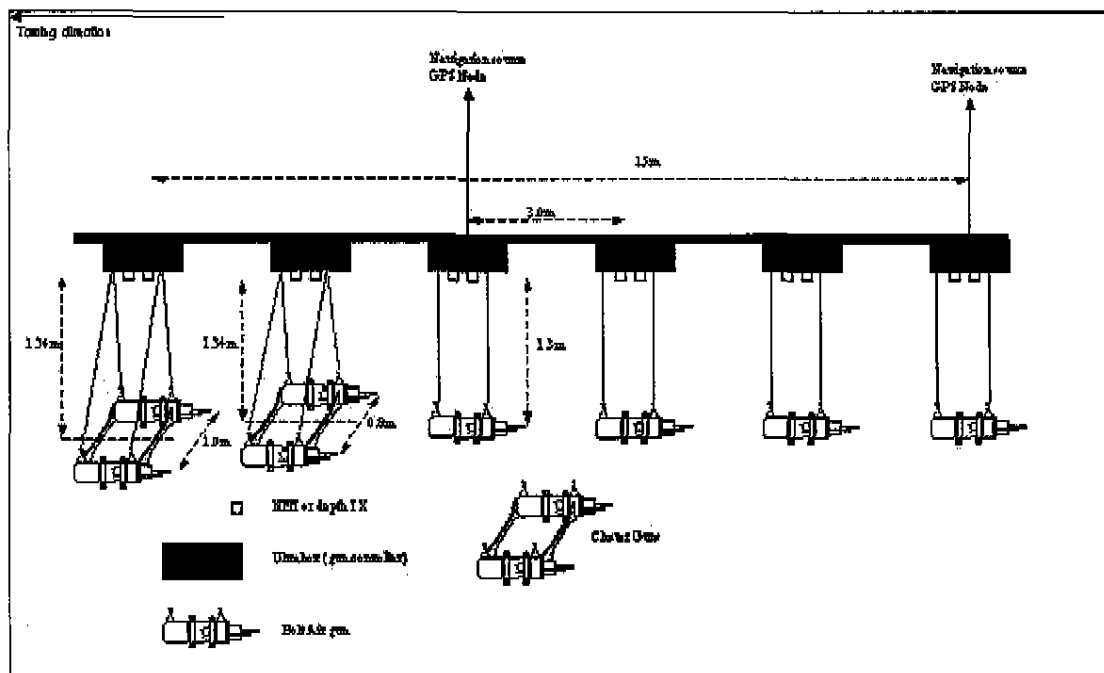


Figure 1 Standard 1049 in³ sub-array

As indicated in the diagram, the sub-array is composed of six tuning elements; two 2-gun clusters and four single guns. The clusters have their component guns arranged in a fixed side-by-side fashion with the distance between the gun ports set to maximise the bubble suppression effects of clustered guns. A near-field hydrophone is mounted about 1 m above each gun station (one phone is used per cluster), one depth transducer per position is mounted on the gun's ultrabox, and a high pressure transducer is mounted at the aft end of the subarray to monitor high pressure air supply. All the data from these sensors are transmitted to the vessel for input into the onboard systems and recording to tape.

The standard configuration of a source array for 3D surveys consists of one or more 1049 in³ sub-arrays. When more than one sub-array is used the strings are lined up parallel to each other with either 8 m or

10 m cross-line separation between them. This separation had been chosen so as to minimise the areal dimensions of the array in order to approximate point source radiation characteristics for frequencies in the nominal seismic processing band. For the 3147 in³ array the overall dimensions of the array are 15 m long by 16 m wide.

3147 in³ Array Signature and Acoustic Radiation Patterns

The following pages show the time series and amplitude spectrum for the far-field signature and the computed acoustic emission pattern for the vertical inline and crossline planes for the 3147 in³ array with guns at a depth of 6 metres.

The signature for this array was computed using GSAP, WesternGeco's in house signature modelling software. The following table lists the gun parameters used as input to the model.

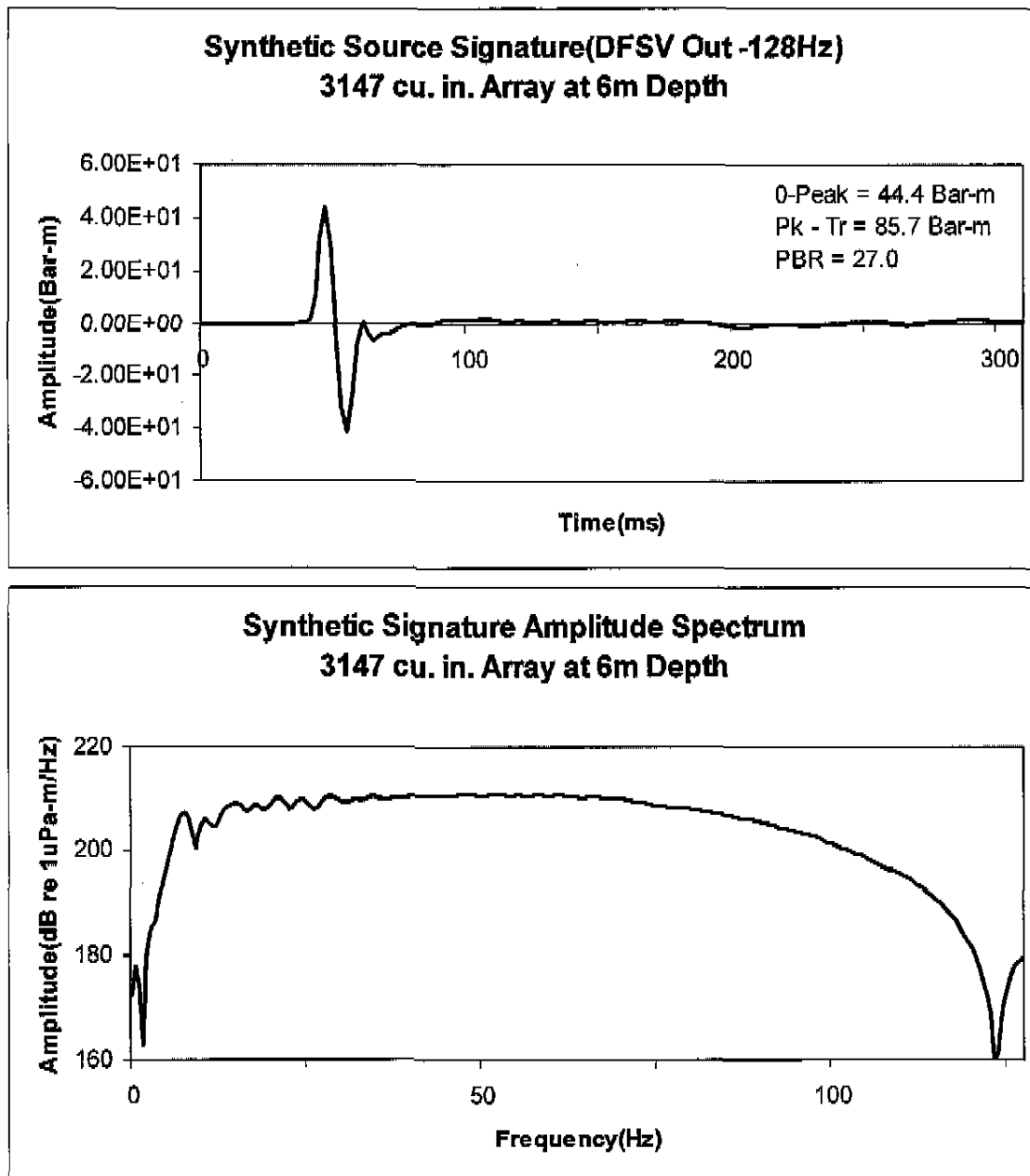


Figure 2 3147 in³ Array Far Field Signature and Spectrum

3147 cu.in. Array Far Field Pressure Distribution

The following figures demonstrate modeled pressure around the array in:

- 0 degree azimuth vertical plane
- 90 degree azimuth vertical plane
- horizontal plane at 20 m depth

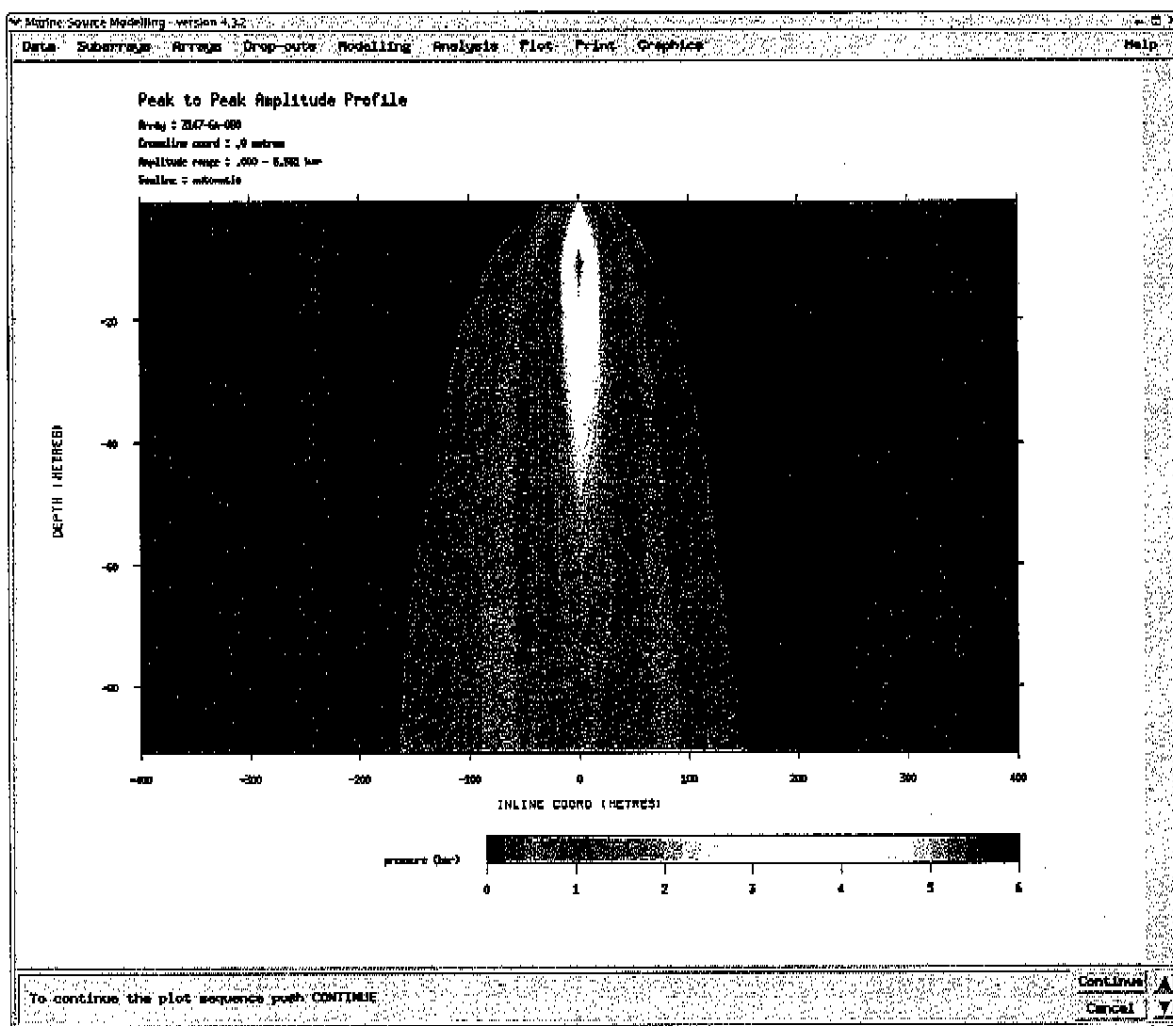


Figure 3 Azimuth = 0 deg. pressure field . Peak to Peak amplitude

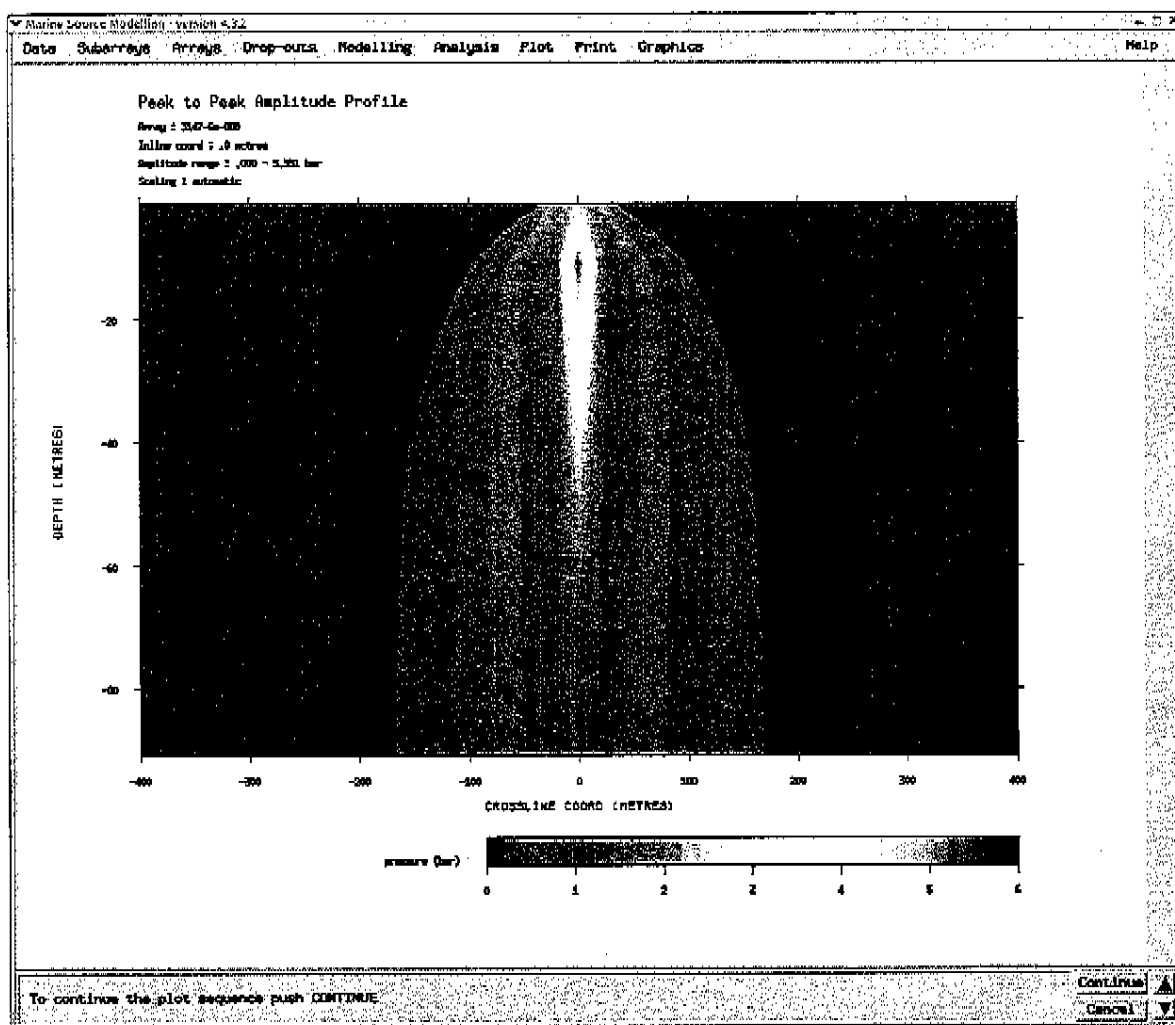


Figure 4 Azimuth = 90 deg. pressure field . Peak to Peak amplitude

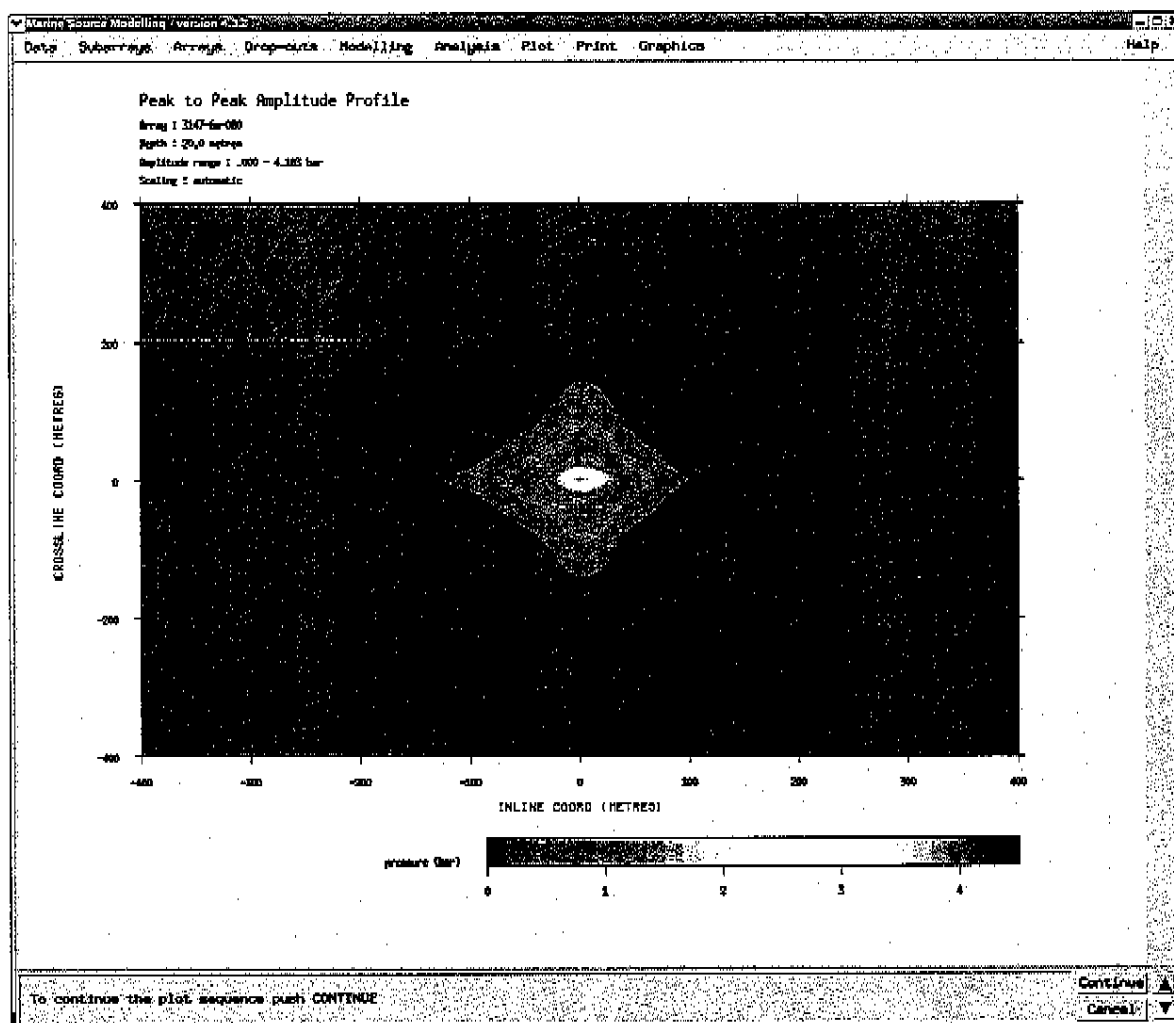


Figure 5 Horizontal plane at 20 m depth pressure field. Area of -400 to +400 m centered on the array. Peak to Peak amplitude. Hatched area enlarged below to show farthest 200m to 400m.

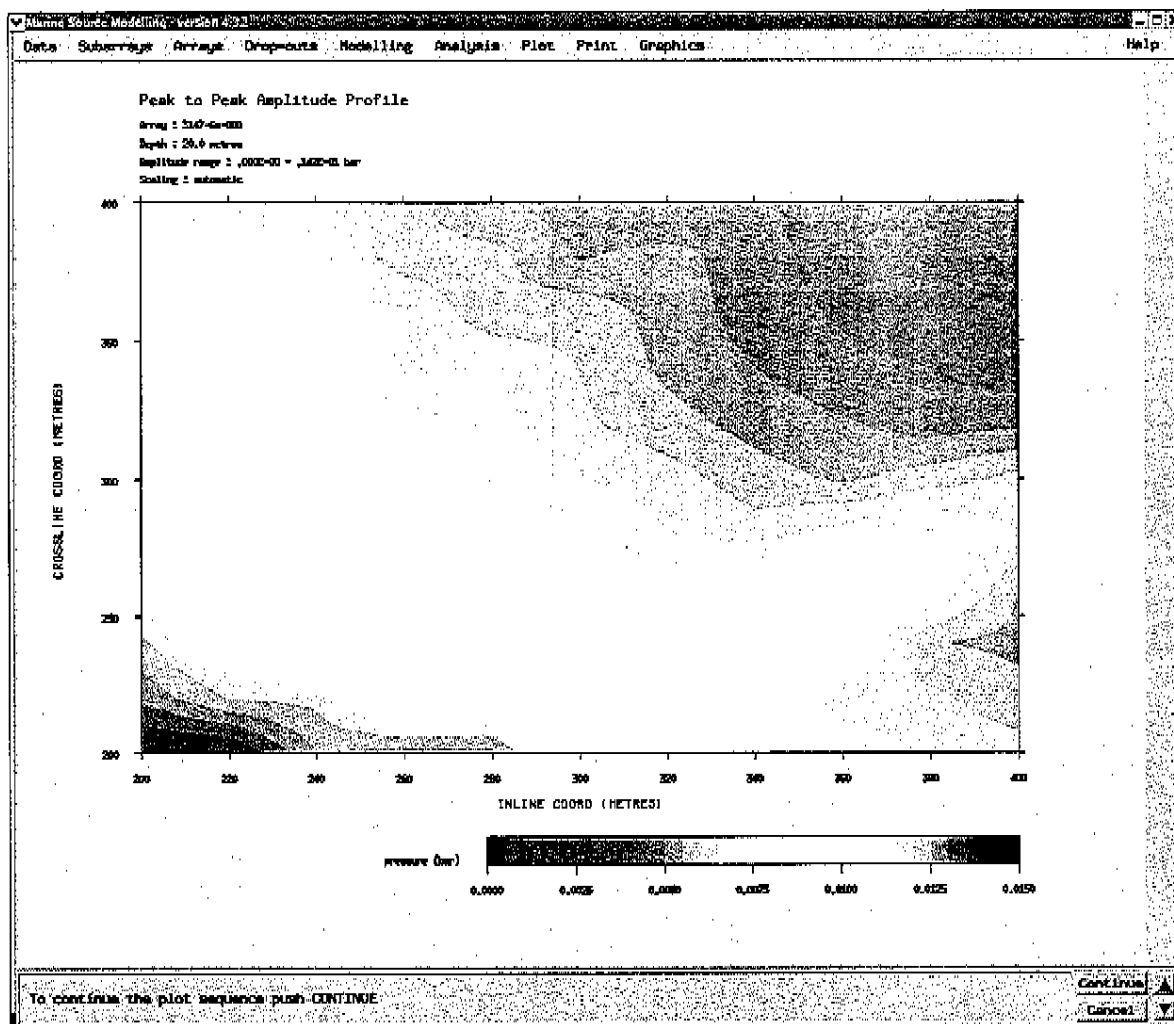
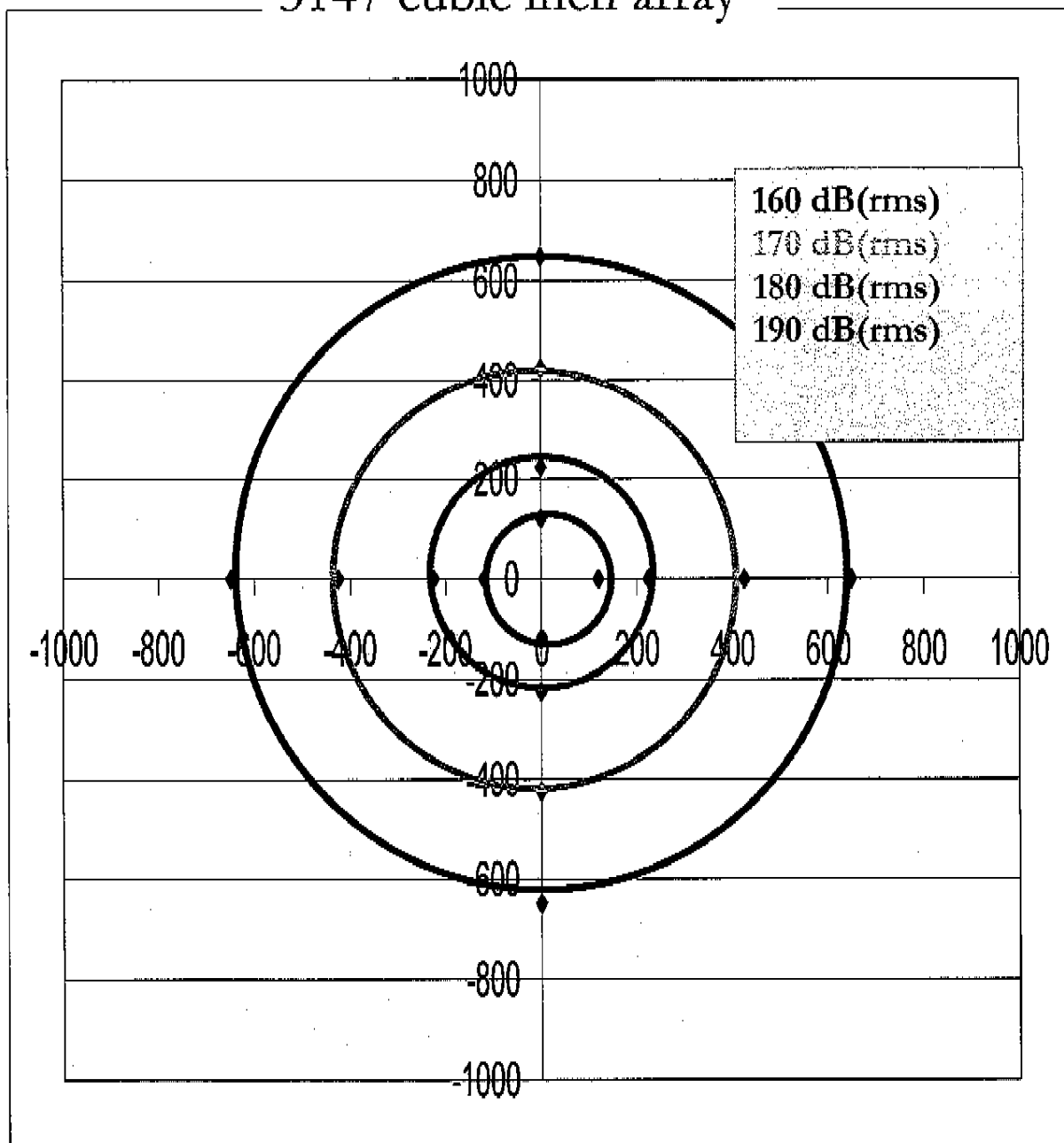


Figure 6 Hatched area of previous figure. Horizontal plane at 20 m depth pressure field. Peak to Peak amplitude

3147 cubic inch array



3147 cubic inch array - Depth = 6 meters

160 dB (rms) :: 169 dB (Peak-Peak) :: 2.8×10^{-3} Bar < 650 meters

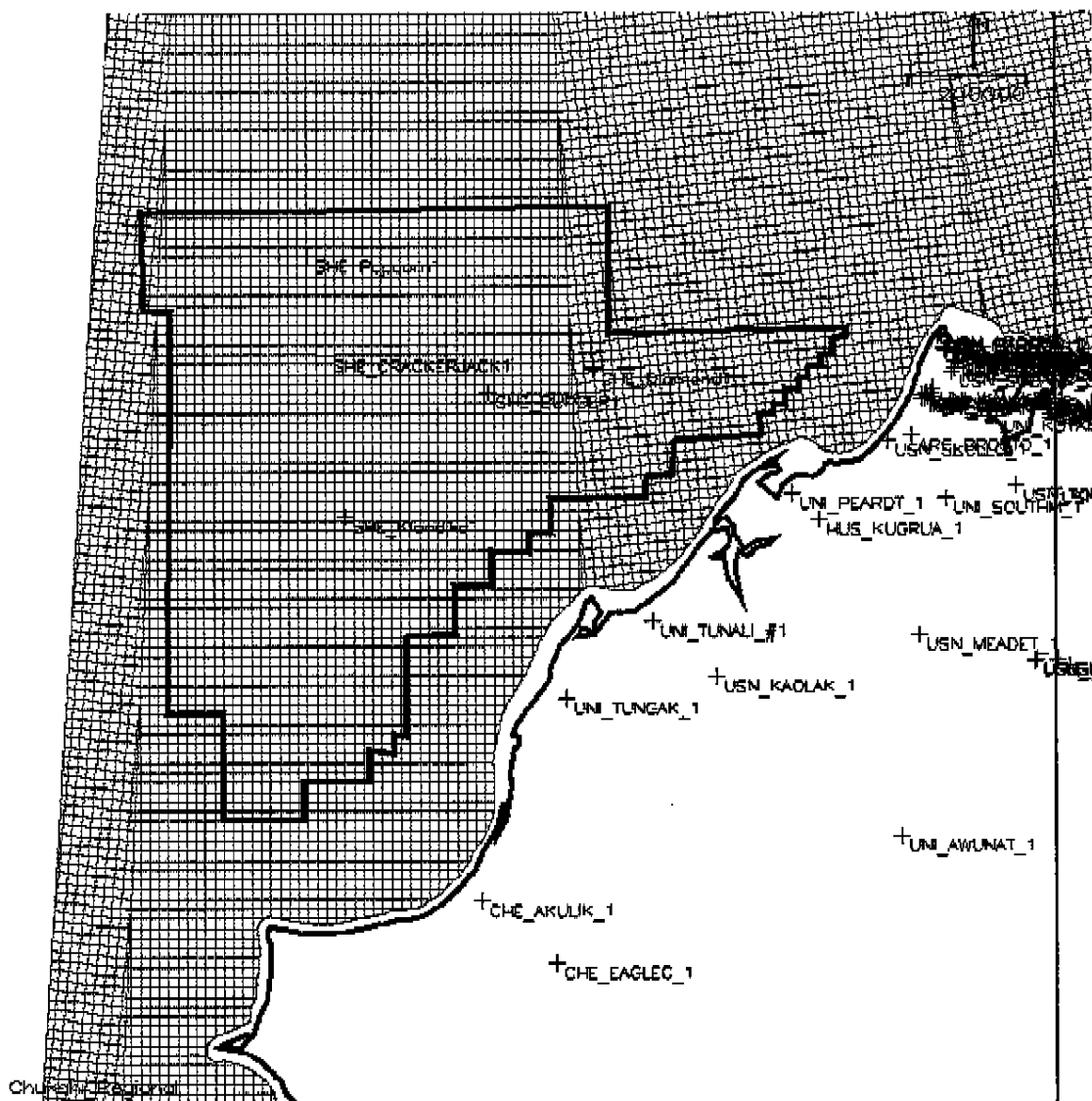
170 dB (rms) :: 179 dB (Peak-Peak) :: 8.9×10^{-3} Bar < 425 meters

180 dB (rms) :: 189 dB (Peak-Peak) :: 2.8×10^{-2} Bar < 225 meters

190 dB (rms) :: 199 dB (Peak-Peak) :: 8.9×10^{-2} Bar < 120 meters

Figure 7 Radii of rms Sound Level output from simulation of 3147 cubic inch source array.

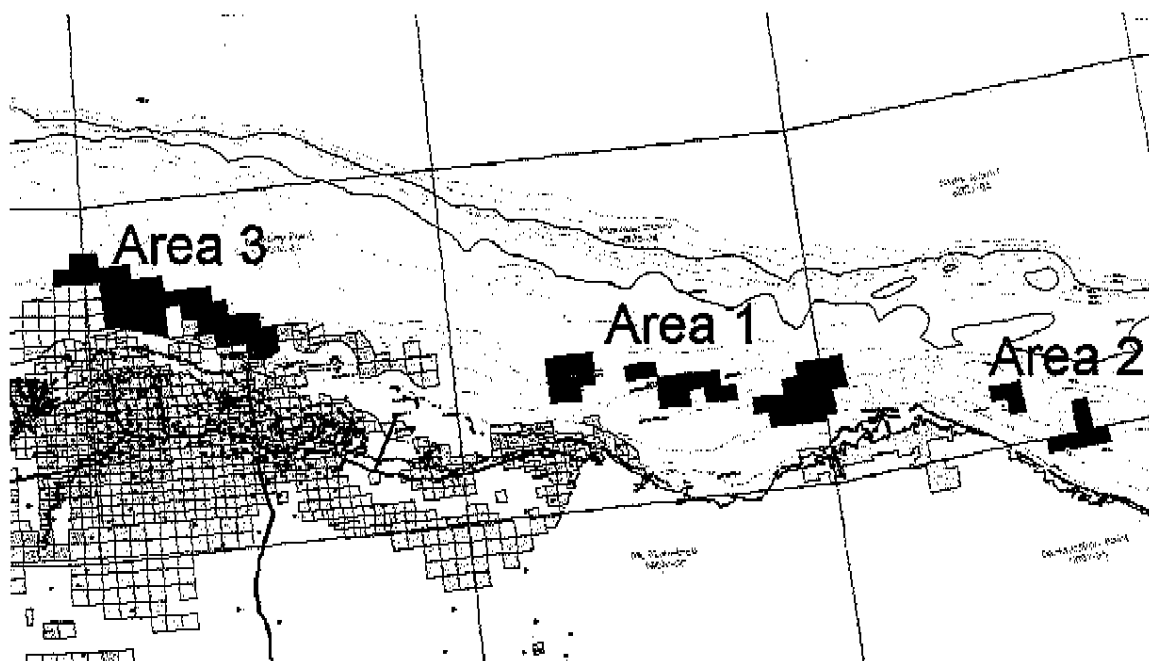
Appendix 4



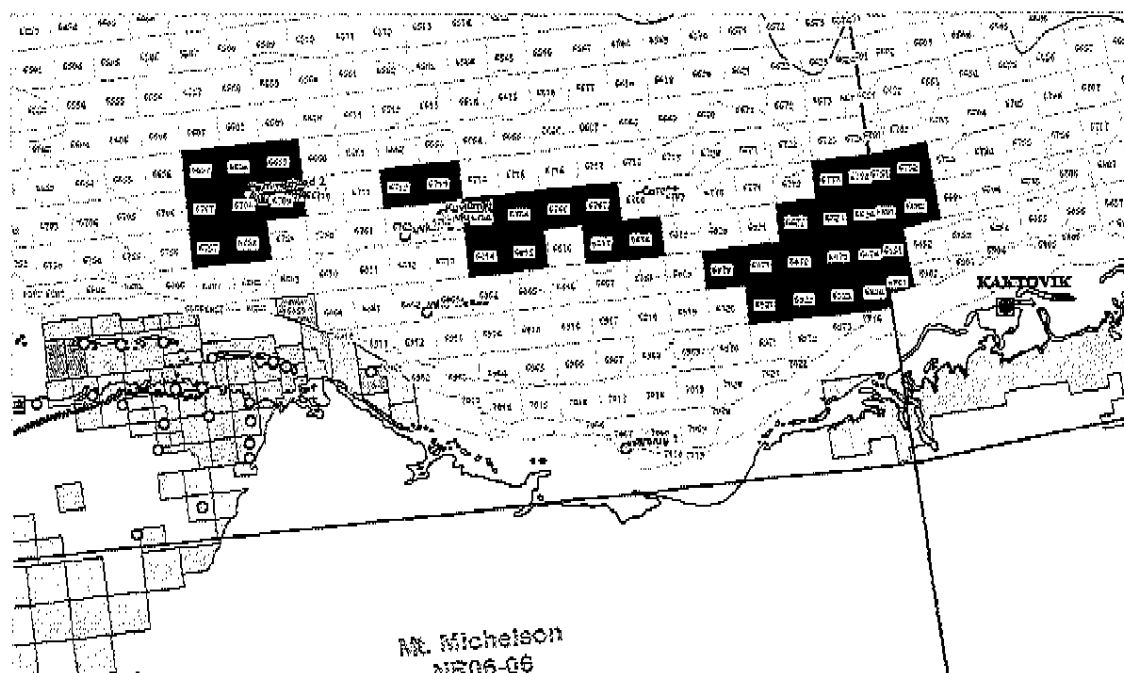
Appendix 5

Survey Areas: Vicinity Map

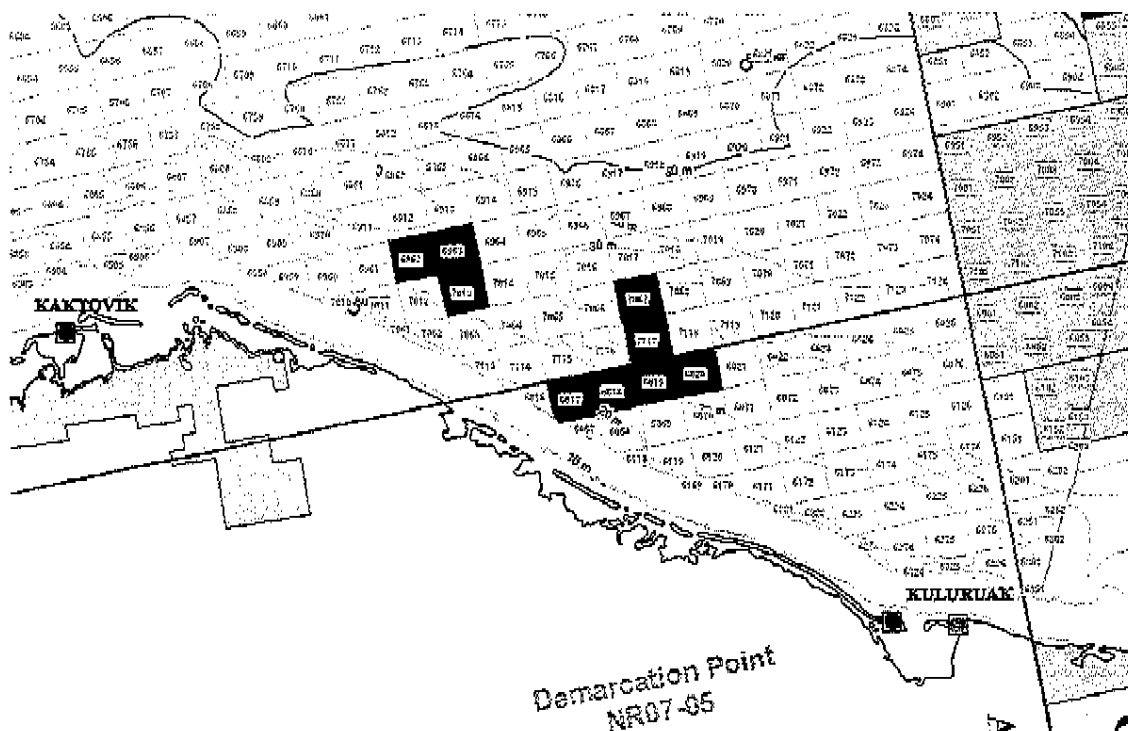
Site Survey areas within three focus areas will be defined.



Area 1



Area 2:



Area 3:

